

ROLE OF LIBRARIES AND THE ACADEMIA IN THE CONTROL OF CLIMATE CHANGE.

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ABSTRACT:

Global climate change has been a global concern to individuals, nations and international organizations in view of its threat to human existence. The average temperature of the earth's surface increased by an estimated 0.6 degrees Celsius in the 20th century and, according to the most recent projections of the Intergovernmental Panel of Climate Change (IPCC), carbon dioxide could rise from about 1.4 to 5.8 degrees Celsius above the 1990 average by the year 2100. In view of this alarming statistical realities and projections, this paper evaluates the importance, causes, consequences as well as the role of libraries and the academia in the control of climate change. Furthermore, this paper recommends the need to sensitize the public through education. In addition, this paper recommends the need for continuous cutting-edge sustainable development policies, programmes and research that would engender environmental safety and security. The need for mitigation and adaptation strategies, as well as increase in scientific capacity is recommended in this paper.

KEYWORDS: Libraries, academia, climate change, mitigation, adaptation, information.

INTRODUCTION

Climate is defined as the average weather condition of a place measured over a long period of time, usually 35 years (Olatoye et al, 2007). As time goes on and there occurs variation in this average weather or previously experienced atmospheric condition of a place, we say climate has risen (Tee et al, 2008). The concept may be defined further as a noticeable change (increase) in the average temperature of the earth's atmosphere, oceans and landmasses often referred to as "Global Warming" (Badejo et al, 2009). Scientists believe that these noticeable changes specified above are caused by the rising levels of heat-trapping gases known as greenhouse gases in the atmosphere. The presence of these gases in the atmosphere is natural; however, since the beginning of the industrial revolution, their increased concentration in the atmosphere is due essentially to human activities. (IPCC, 2001 & 2007). From the foregoing, it is clear that climate change is already here with us. This is made manifest by the observable changes like increased surface temperature of the earth, sea level rise leading to more flooding, and the melting of the polarized ice caps. Others Are changes in rainfall patterns and widespread storms. These changes have far reaching consequences, and they impact directly or indirectly on national and household economies.

JUSTIFICATION FOR THE PAPER:

This paper underscores the importance of libraries and academia in the control of climate change. From the foregoing, libraries serve as highly trusted and effective institutions to organize, manage, and store collections of information. On the other hand, the academia conducts scientific evaluations and predictions of the problems associated with climate change.

In addition, this paper provides a platform of unifying the roles of libraries and academia as sources of information, control adaptation and mitigation of the environmental phenomena of climate change.

THE EFFECTS OF CLIMATE CHANGE:

Climate change is a deviation from the normal climatic condition of an area due to land, atmosphere, land-ocean and ocean-atmosphere interactions which cause alterations in the balance of gases in the atmosphere, otherwise called radiative forcing factors responsible for global warming and climate change. (Okali, 2004). The effects of climate change include the following:

- **Increased Surface Temperature of the Earth:** The inter-governmental Panel on Climate change (IPCC, 2007) reported that the average surface temperature of the earth has risen by about 0.7 Celsius degrees. The report further predicts that temperatures may rise by about 3 Celsius degrees by the end of the 21st century, and the tropical and the tropical and subtropical climatic regions would be most affected. By this report, Nigeria and many African countries are likely to suffer the burden of climate change.
- **Sea Level Rise and More Flooding:** Tide gauge data have shown a global have a global average sea level rise of between 0.1 and 0.2 meters during the 20th century. By the end of the 21st century, sea level rise might hit 0.59 meters (IPCC, 2001). Heat waves and periods of rainfall are very likely to become more frequent. In Nigeria, similar rise are being experienced especially around the coasts and sea ports prominent among which is Lagos and Port-Harcourt areas (Babalola, 2009). The major rivers (the Niger and Benue), and even minor rivers in the country are being overflowed because of the swelling volumes of water in these rivers as against prior experiences.
- **Melting of Polar Ice caps:** Satellite data have shown probable decrease in snow cover and ice extent by 10% since the late 1960s, and ground-based observations show that there is proof that there has been reduction of about two weeks in the annual duration of lake and river-ice over in the mid and high latitudes of the of the northern hemisphere, over the 20th century. During the same period, widespread retreat in mountain glaciers in non-polar regions was also experienced (IPCC, 2007). Similarly, northern hemisphere spring and summer sea-ice extent has decreased by about 10-15% since the 1950s. IPCC, 2007 also projected that there has been about 40 % decline in the arctic sea-ice thickness during late summer to early autumn in recent decades and a considerably slow decline in winter sea-ice thickness.
- **Increases in the Frequency & Intensity of Drought:** This is experienced in some regions of like Asia and Africa. In Nigeria, the Sahara Desert is fast encroaching southwards, turning most of the semi-arid regions of the savannah lands into deserts.

LIBRARIES:

Historically, it has been the task of libraries to act as the main centers for collecting, making accessible and distributing information in the form of documents. The documentation service must meet special requirements as regards a more detailed recording and deeper accessibility of the contents of the document, as well as providing a quick and efficient dissemination of information.

At each level of our educational system, the Library is an invaluable resources center, as well as being the storehouse of information and its unparalleled importance to educational development. The library is commonly referred to as the “heart” of the school system and its book collection, one of the pillars of the whole structure of education (Oguntimehin et al, 2004). The role of library is two-fold- educational and recreational. A wide range of reading/studying is required for any course, research, research or discipline if academic excellence is to be achieved. The information, whether in raw form of empirical data or in the highly processed form we call “knowledge” is regarded as very essential to academic pursuit.

Library services/facilities are custodians and dispensers of recorded knowledge in every form. Furthermore, libraries must be adequately equipped, organized, financed and interconnected and their resources are to be available to all people.

It is almost impossible to read through the bulk of information that has been published about the developments in the library world and the different types that have emerged. Different types of Libraries have developed in accordance with the needs and requirements facing them, in line with the demands arising from the development of science, technology and research in different countries. This is the reason that no standard library typology can be made, as every library has evolved its own library system. Bearing this limitation in mind, an attempt has been made in the construction of a generalized typology for the classification of libraries as listed below:

TYPES OF LIBRARIES:

According to the Technical Centre for Agricultural and Rural Cooperation (1984), the types of libraries include the following:

1. National Libraries: These are deposit libraries containing national bibliographies, central catalogues, etc.
2. Libraries of International Organizations, such as the United Nations Scientific and Cultural Organization (UNESCO), Food and Agricultural Organization (FAO), etc.
3. Academic & University Libraries: These include university/college libraries, polytechnic libraries and libraries of attached research institutes.
4. Special Libraries: These are libraries organized under the sponsorship of a parent enterprise or organization which provides the funds for its support and continuance. Furthermore, they are assigned the mission of acquiring, organizing and providing access to information and knowledge so as to further the goals of its parent enterprise or organization. Examples of these include government libraries (in courts, ministries), libraries of independent research institutes, libraries of business enterprises (private and international, private and public) and libraries of non-profit organizations.
5. Public Libraries: These are libraries open to members of the public which provide information on wide-ranging topics.

THE ROLE OF LIBRARIES AS SOURCES OF INFORMATION ON CLIMATE CHANGE:

Libraries serve as highly trusted and effective institutions to organize, manage, and store collections of information (Akintola et al, 2009). Librarians and information professionals are primary gateways to these collections and the services and resources supporting them. International research agendas and policy initiatives related to global change provide libraries and librarians new opportunities for identifying, obtaining, managing, storing, and disseminating current data and information in new formats and through new channels of communication. For example, Librarians have played important roles in the U.S. Global Change Research Program's Global Change Data and Information System (Stoss, 2000). Their expertise has been used to: develop metadata and data standards and directories, build Web pages (including their search capabilities, menu-driven interfaces, and content), improving access to data and information resources via the Internet and World Wide Web.

Librarians have also lead data and information management activities to improve identification of, access to, and sharing of electronic and print forms of data and information. However, new opportunities also come with new barriers to change. These barriers represent limitations to convey our scientific understanding of complex phenomenon (such as climate change), inadequacies in (and access to) the technologies needed to obtain and organize scientific and policy data and information, and our ability to effectively and efficiently share data and information in an equitable manner. International global change research programs provide libraries and librarian's new roles and responsibilities to facilitate the sharing of data and information resources across disciplines, lines of work, and personal agendas. This presentation will examine the roles of librarians in sharing data and information resources and how public, academic, government agency, and special libraries can be used as active partners with research and policy communities in sharing global climate change data and information.

Ready and reliable access to data and information is increasing in importance as an integral part of the environmental decision-making process. Research results, regulatory requirements, policy, initiatives, and increased public awareness and concern about the issues related to global climate change have a dramatic impact on constituent groups. Project managers, business leaders, research scientists, policy analysts, program administrators, elected officials, educators and their students, and the concerned citizen need efficient, effective, and equitable access to data and information to adequately address their issues related to climate change. Their need for new data and information products, new publications and documents, new reference and referral services, and new data and information delivery services is a challenge for today's librarians and information professionals. Librarian developing and providing such services and programs for this multidisciplinary audience are building bridges to facilitate information, communication, and education gaps between constituent groups and foster a greater cross-disciplinary exchange of information, resources (materials and expertise), and ideas. Today's librarians find themselves in roles far removed from the traditional roles as cataloguers, indexers, and collection caretakers. Their skills are needed to collaborate with researchers, policy makers, educators, administrators, and executive as they evaluate software for data and information management

- Develop profiles of information products, research projects, business plans.
- Oversee the production of reports, reference books, Web sites, and other information tools.
- Develop and maintain databases.
- Write articles and reports.
- Provide training in the use of manual- and online data and information systems.
- Develop marketing strategies for the effective delivery of products and services.

There are, however, barriers that prevent the efficient, economic, and equitable access to data and information resources.

SCIENTIFIC BARRIERS TO CLIMATE CHANGE INFORMATION:

International scientific research programs spanning decades in their duration have contributed greatly to our understanding of the biogeochemical dynamics of the Earth's biotic and abiotic resources (Stoss, 2000). This research effort presents a tremendous challenge in the understanding of the complex nature of ecological systems and their interactions. These interactions involve mechanics and dynamics of chemical, biological, physical, and social sciences from the depths of the ocean to the upper reaches of the Earth's atmosphere (Olatoye et al, 2008).

The worldwide global change research programs struggle with these scientific and technical complexities which are exacerbated by issues of scale from regional to national to global dimensions; and issues of scale that range from the immediate to several centuries in duration between cause and effect. As our resolution for measuring and predicting change increase so does the need for sophistication of information and information delivery systems increase.

The issues of spatial and temporal change are among the most difficult to convey even among scientific disciplines. These issues are often cited as causing tremendous degrees of confusion among non-scientific audiences, including those who are called upon to make critical decisions about research priorities, strategies for remediating problems, revising the allocation and uses of natural resources. Along each step in the research and policy process is the need for information that, according to Root (1992):

- is reliable
- covers adequately the subject area for which information is needed

- is accessible to those who need it
- is understandable to those who wish to use it

HOW LIBRARIES OVERCOME SCIENTIFIC BARRIERS TO CLIMATE CHANGE INFORMATION

It is a great challenge for our libraries and librarians to assure access to and discern the quality of climate change data and information that stands up to the measures of reliability, adequacy, accessibility, and comprehension. Librarians serve as stewards of the information and knowledge base of their library's holdings through strategies they employ in developing collections of books, technical reports, research journals, monographs, reference works, and other forms of print and non-print resources (including electronic and digital resources). Library collections are developed through cooperation and idea sharing among librarians (who identify and obtain information) and researchers, policy makers, educators, managers, and others who state specific information needs. Librarians rise to the challenge with a variety of tools: catalogues, indexes and abstracts, reviews, peer-exchanges, recommendations, and their own in-depth, academic understanding of the subject matter, to facilitate the building of library collections. The development of subject- and issue-specific library collections is a basic function of librarians, and one that has tremendous potential for interactions among librarians and other segments of the community of information users. Of particular interest is the professional working relationships librarians develop among peers and other practitioners in research, education, and policy settings. It is through these relationships that librarians are guided in the selection of data and information resources appropriate for the users of their library.

The need for librarians to network among their peers, producers and publishers of information, and their user communities will determine the success with which they are able to meet specific data and information needs that often cross lines of disciplinary study in the applied, life, physical, and social sciences. A major extension of library collection development comes into play when a library does not have immediate access to a desired piece of information. Librarians may employ a number of time-honored referral services, based primarily on their personal knowledge of where appropriate data and information resources are found. In this context the professional networking among librarians is essential to facilitate a cross-disciplinary exchange of resources. The most visible library resource-sharing program is the international arrangement honoring interlibrary loans (ILLs). As defined by the National Interlibrary Loan Code for the United States, 1993, "Interlibrary loan is the process by which a library requests materials from, or supplies materials to, another library. The purpose of interlibrary loan as defined by this code is to obtain, upon request of a library user, materials not available in the user's local library.

Most libraries extend the limits of their collections by making a full range of interlibrary loan (ILL) services available to their users. Limited ILL services may be extended to those not officially belonging to a library's user community. The services provided through various consortia and lending networks are governed by the conditions set by the interlibrary loan code of the American Library Association and by the regulations of individual lending libraries. Requests for photocopies may fall under the restrictions imposed by the federal copyright guidelines enacted in 1976 (Title 17 U.S. Code). These services may be provided free of charge to the user (typically in academic and school libraries), are provided on a cost recovery basis, or may be used to provide a revenue-generating function for the library. Informal referral services are another tool librarians employ to provide a user with resources not held in their library. Such referral services are based on the librarian's knowledge of where specific data and information resources are or most likely will be found. Directories of information resources, research centers, special library collections and special librarians, data archives and information analysis center are among the most frequently used tools for providing referral services.

It is, therefore, necessary for the librarian to have a working knowledge of the special collections of other libraries, national and World Data Centres, information clearinghouses, data archives, and information analysis centres. This networking among librarians is developed through participation in the professional associations as societies of librarians and data and information managers. Another aspect of library collection development activities is the creation of subject-specific Web sites of Internet and World Wide

Web resources. These library Climate Web Pages tend to reflect the specific research and education missions of the institutions in which the library is located.

TECHNOLOGICAL BARRIERS TO CLIMATE CHANGE INFORMATION & LIBRARY SOLUTIONS:

In recent years the computer, in all of its variations from pocket/palm units to large, multi-tasking, networked, supercomputers, has been the very heart of the current information revolution. The topic of climate change has been described as one of the most scientifically and technically complex research investigation undertaken in history. It is certainly the most data and information intensive studies ever undertaken.

The combination of highly complex data and information resources, the need for sophisticated computer hardware and software to collect, manage (organize), evaluate, display, store, identify, retrieve, disseminate, and archive these data and information resources provides one of several technological barriers to information. The first barrier is access to the technologies delivering data and information resources from those that generate the data and information to those that need it.

Libraries at all levels - school, academic, government, public, and other special libraries - overcome this barrier by providing computer hardware and software, and training for their effective use. From elementary schools to university research libraries the acquisition of computer technologies grows at astronomical proportions.

However, there is, at the same time, a schism developing creating a new dimension to the barrier of access to information technologies - those that have the technologies and those that do not. There are several factors that facilitate the means for overcoming this barrier. The efforts for providing grants for the purchase of computer hardware and software include those of the Gates Foundation for public libraries, and the efforts undertaken through individual state, county, municipal governments and school districts to seek funding for the public and school libraries they support.

There have been several initiatives to bring specific software capabilities and technical expertise into libraries. GIS Literacy in Libraries <http://www.arl.org/spec/238fly.html> was a joint effort by the Association of Research Libraries and the Environmental Science Research Institute (ESRI) sponsored program to introduce GIS technologies in libraries with grants for hardware, software, and training of librarians. Librarians, especially those working in or with federal agencies funding and conducting climate change research, have made significant strides in providing institutional support for library-access to climate change data and information resources, services, and products. Realizing that the primary role of libraries is to organize, manage, and store collections of data and information resources, librarians representing various constituents of the U.S. Global Change Data and Information Systems created the Library Information Subgroup of the Global Change Data Management Working Group. Highlights of this Library Information Subgroup include the following action items (Rand, 1995):

GCDIS Thesaurus Project (1993): This action involved the development of alternatives to controlled vocabulary keywords. Existing keyword vocabularies, dictionaries, and glossaries were used to develop and enhance a natural language access to the growing Global Change Master Directory (a NASA/GCDIS-supported access portal to data and information resources).

Assisted Search for Knowledge (ASK, 1994-1995) The fundamental concept behind ASK was the development of a prototype system linking databases "diverse in format and content over the Internet while enabling users with different skills, needs, and access methods to obtain relevant information from these databases by using natural language inquiry and a common user interface" (Rand, 1995).

Global Change Master Directory (1989-present) The GCMD is one of NASA's contributions to the GCDIS effort. It offers a comprehensive source of information about the worldwide holdings of Earth science data and information resources for science, research, policy, and education communities.

LASR - Library Access, Search, and Retrieval Pilot Project (1994-1996) Developed at the University of Virginia LASR provided a network of public libraries, public schools, a community museum, environmental groups, community colleges, four-year liberal arts colleges, and research universities. LASR was created as a test structure to investigate the access to data and information resources across disciplines and information needs, and demonstrate a mechanism for collaboration and resource sharing in a networked environment. Other more technical aspects of the Library Information activities include the following:

- Management of metadata
- Development and implementation of data and information standards for GCDIS project.
- Conversion of data sets, data files, and other information resources from DIF (Directory Interchange Formats) to USMARC format.
- Working with USGCRP's Global Change Education and Communications Working Group development of "Project Earthlink" (K-14 education and information awareness).
- Participating in the development of the National Information Infrastructure's Government Information Locator Service.

THE ROLE OF THE ACADEMIA IN THE CONTROL OF CLIMATE CHANGE.

For the studies of these global issues, contributions from academia are vital. An example of this is the Intergovernmental Panel on Climate Change (IPCC), which has achieved a great success in conducting scientific evaluations and predictions of the problems associated with climate change, the role of leading research universities is enormous. The issue of global sustainability is multi-faceted and the realization of sustainable earth calls for the academia to put its intellectual resources together; thus leading research universities now must join forces to form a new framework. As the G8 nations are expected to play the leadership role in this field, the G8 University Summit aims to make international contributions representing academia through inter-university cooperation to achieve the sustainability of the global, social and human systems and their mutual relationships.

Education is another important role that these leading research universities play in achieving the goals such as those described above. To realize sustainability, an approach with a super-long term perspective spanning the entire 21st century must be taken, and the next generation must be educated to carry on the objectives accordingly. We believe that the promotion of education on sustainable development and construction of an international network through the cooperation of leading research universities in the developed countries, including the G8 nations, and major emerging economies, including China and India, will contribute enormously to the establishment of a sustainable society including achieving the goal of millennium development.

RECOMMENDATIONS and CONCLUSION

The impact of climate change is of major importance to future human welfare. Many potential problems such as decreases in vegetal productivity and environmental degradation may result from climate change. From the foregoing, the following suggestions are made in order to curtail the effects of climate change:

- There is need for sensitization/awareness through education. It is a very important modality of disseminating information to the grassroots. An understanding of climate change is important for encouraging and implementing appropriate adaptations. Information needs to be disseminated concerning:
 - The nature of climate change and its potential to cause problems in all aspects of life.
 - The potential impacts both in the short and long-term;
 - Adaptation options available to man.

This can be achieved through the print and electronic media, by governments, International Organizations, NGOs, CBOs and the academia. Others include public outreach programmes, national campaigns, presentations and stakeholder workshops on climate change issues.

- There is need for the continuous provision of cutting-edge sustainable development policies, programmes and research that would engender environmental safety and security. Examples of these include the adoption of sustainable forest management options , reduction of carbon emissions, carbon sequestration, adoption of best farming techniques, afforestation, reforestation, sustainable harvesting methods, agroforestry, forest protection and sustainable production of wood fuels, just to mention a few.
- Mitigation & Adaptation Strategies: These are two approaches that are needed to tackle climate change. Mitigation strategies are actions that tackle the causes of climate change, such as reducing greenhouse gas emissions, while adaptation strategies are actions that minimize the consequences of actual and expected changes in the climate, such as the strengthening of traditional coping mechanisms.
- Increasing Scientific Capacity: Increasing scientific capacity by improving access to climate data, development of modeling capabilities and having mechanisms in place to process and disseminate the data for users, helps promote awareness of potential climate change impacts. It also equips nations with climate information necessary for national impact assessments, and adaptation and development planning, hence, increasing their capacity to adapt.
- Information networking: This should be encouraged between government (at federal, state and local levels), non-governmental organizations, media, libraries, academia and environmental information societies. Such synergy will be enhanced through the establishment of a National Information Centre on Climate Change. This establishment will be saddled with the generation, collation, storage, evaluation and supply of information and the formulation of policies on climate change control/ environmental management and protection.
- It is also recommended that the National Policy on Environment be reviewed to incorporate mitigation and adaptative measures that would combat issues on climate change.

REFERENCES

Akintola B.A.; Olatoye T.A.; Akalumhe C.D.; Pelemo O.J. & Fagbami O.O (2009): Information and Awareness Strategies on Climate Change: Prospects for Nigeria. Published in the Journal of Library & Information Science, Olabisi Onabanjo University Library, Ago-Iwoye, Nigeria. (January, 2009).

Badejo S.O.O; Akintola B.A; Olatoye T.A & Pelemo O.J (2009): Building Nigeria's Capacity to Adapt to the Effects of Climate Change: Published in the 2nd Annual Proceeding of the Institute of Environment & Ecology, Obafemi Awolowo University, Ile-Ife, Nigeria, held in June 9-11, 2009.

Babalola F.D (2008): Impacts of climate change on biodiversity (Proceeding of the 1st Annual Conference of the Institute of Ecology & Environmental Studies, Institute of Environment & Ecology, Obafemi Awolowo University, Ile-Ife, Nigeria, 2008).

CTA (1984): Proceedings of the Seminar on Scientific & Technical Information for Agricultural & Rural Development, held at Montpellier, France (Vol. 1).

ESRI, 2006: GIS Literacy in Libraries <http://www.arl.org/spec/238fly.html> A joint effort by the Association of Research Libraries and the Environmental Science Research Institute

IPCC Third Assessment Report (2001): Impacts, Adaptation & Vulnerability. Library of Forestry Research Institute of Nigeria, Headquarters, Ibadan, Nigeria.

Oguntimehin Y.A & Adeyemi O. (2004): Functional Library School System: A Major Success Tool for an Effective Universal Education Programme. Journal of Library & Information Science, Olabisi Onabanjo University, Ago-Iwoye, Nigeria. (Dec. 2004).

Okali D.U (2004): National Environmental Study Action Team Publication.

Olatoye T.A. & Pelemo O.J. (2007): Climate Change and sustainable forest management.

Olatoye T.A. & Pelemo O.J. (2008): Causes and implications of climate change in Nigeria. Published in the 32nd Annual Proceeding of Forestry Association of Nigeria (FAN), in October 20-24, 2008.

Rand R.Y (1995): Assisted Search for Knowledge: Bulletin of the American Institute for Information.

Root (1992): Research and Policy Process

Stoss F.R (2000): Global Climate Change Information: The Role of Libraries in Removing Barriers to Information.

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